demise of its Founder, in 1832, I deem it more probable that a like lapse of time after the issue of the present volumes will have been attended by such rich results to the young and ardent naturalists of Australia as to show that their predecessor at home had but 'skimmed the cream,' and given them the broad outlines of a picture of ancient animated nature which their labours will fill in and finish."

In the descriptions and plates of the present work, devoted not only to the characteristic fossils of the extinct families, genera, and species, but also to the dentition and osteology of the still existing types, the generations issuing from the colonial schools, colleges, and universities of Australia, of whom some may be irresistibly led, like those of the present generation of Anglo-Americans, to investigate and interpret the phenomena of an environing nature, will find an instrument which will facilitate and accelerate their endeavours to reconstruct the strange forms of mammalian life which once traversed the Australian plains and scrubs and have long since passed away from that continent.

In Prof. Owen's aim to elucidate the palæontology of the colonies of Great Britain the present work maintains the character and claim on favourable reception of that on the Fossil Reptilia of South Africa, noticed in the 'Annals' for June 1876.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

April 12, 1877.—Dr. J. Dalton Hooker, C.B., President, in the Chair.

"On the Rapidity of Growth and Variability of some Madreporaria on an Atlantic Cable, with remarks upon the rate of accumulation of Foraminiferal Deposits." By Prof. P. Martin Duncan, F.R.S., Pres. Geol. Soc.

A telegraph-cable was laid off the north-west of Spain in 1870, and a portion of it was recovered in 1876, in long. 9° 4′ W. and lat. 44° 6′ N. The depth from which the recovered portion came was from 522 to 550 fathoms; the ground was conglomeratic, and there was a deposit there of sticky foraminiferal mud. Much coral-growth had occurred on the cable, and when it was fished up some living and dead forms, together with *Echini*, Pectens, and mud, came up from off the surrounding sea-floor.

The growth on the cable consisted of numerous individuals of *Desmophyllum Crista-Galli* of different sizes, and of many bush-shaped coralla of *Lophohelia prolifera*, var. *gracilis*; there were also small masses of *Solenosmilia variabilis* (nobis), a new *Am-*

phihelia, and a specimen of *Caryophyllia cylindracea* (Reuss), which were not attached, but which must have been fixed close by to stones.

As the date of the sinking of the cable was known, and as six years had elapsed, it was possible to estimate the rapidity of the growth of the coral on it, and also to come to some more or less satisfactory conclusions regarding the rate of the deposition of the foraminiferal ooze in that situation. Moreover a glance at the numerous specimens showed that they presented variations and abnormalities of structure well worthy of examination, and which might relate to the inadvisability of retaining some of the specific and generic determinations in the ancient and recent coral faunas.

The height of the tallest* *Desmophyllum* taken from the top of the cable, to which its base is strongly adherent, is $1\frac{2}{3}$ inch. It is a fine and well-grown individual, being $1\frac{1}{5}$ inch in its calicular length, and its hard part weighs $\frac{1}{5}$ oz. There are no indications of ooze having covered the base, and the granulation of the basal surface is perfect and free from any evidence of erosion.

The smallest specimen found on the cable has its calicular edge rather on one side and oblique, and it is $\frac{4}{10}$ of an inch above the attached base. It shows no trace of ooze; the other specimens, intermediate in size, usually present an excessively broad base below the peduncle, and in some it extends for nearly $\frac{1}{2}$ inch on all sides. It consists of a layer of carbonate of lime, granular above and attached below to the outer coating of the cable.

Stunted bush-shaped masses of *Lophohelia* adhered by broad bases to the cable, and extended along it for many inches. The corallites composing the masses were crowded together to the height of an inch from the cable, and a few reached upwards about $\frac{3}{4}$ of an inch above the rest. Some had grown up obliquely, and others had their calices turned downwards, so that their margins were not $\frac{1}{10}$ of an inch from the cable. They must have always been above the ooze.

Gemmation appears to have occurred four times in the tallest corallites, commencing on the parent when it attained a certain size: probably the parent growth occupied one year; and there were four consecutive yearly buddings.

From these details it may be gleaned that the upward and general rate of coral-growth at 550 fathoms is rapid in relation to that noticed in Europe in the same family in shallower water. In height the growth amounts to a minimum of 0·29 inch in the year, and in mass it is very considerable.

The amount of sedimentary deposit, consisting of the tests of Foraminifera, sponge-spicules, and minute particles of siliceous minerals, has been inappreciable on the cable during six years. A few Foraminifera in crevices in the bases of a few specimens are

* The *Desmophylla* and *Lophoheliæ* are essentially oceanic deep-sea corals; they have none of the exotheca which distinguishes the rapidly growing littoral reef-building forms.

the only signs of its presence. But that there was plenty of sticky ooze close by is evident; for some was brought up by the apparatus, and it had got into parts of the calices of some of the living corals. Moreover a mass of conglomerate which was brought up, and which consisted of water-worn gneiss boulders cemented together, had some of the mud entangled in it; and most of the calices of the dead corals which were brought up at the same time, but which were not attached to the cable, contained a small quantity of foraminiferal and siliceous matter.

It is possible that the motion of the tentacles and of the cilia of the corals prevented the accumulation of sediment in their neighbourhood; but the tall peduncles of some of the *Desmophylla* would place their calices far out of the way of matter collecting on the base. Moreover the part of the cable on which the coral grew may have been laid on masses of stone above the level of the deposit. But the facts that the calices of the living *Amphihelia* brought up, and which was not growing on the cable, contained no deposit, and that the dead *Solenosmilia* and a short *Caryophyllia*, neighbours to the form just noticed, had very small amounts in their calices, which had long been dead, and had been worn by *Achlya penetrans* and some Spongida, are of themselves sufficient to disprove a rapid rate of accumulation. The presence of some most fragile outgrowths from the Lophohelian corals which supported and partly enclosed the stems of some Hydroida contra-indicate the existence of a current sufficient to move sticky ooze.

It may be considered, then, that the deposit of minute sedimentary matter and of pelagic Foraminifera is excessively slow in its rate of accumulation at 550 fathoms on this part of the Atlantic floor, and that it is very much slower than the contemporaneous coral-growth.

An examination of some of the deep-sea corals of the true *Globigerina*-ooze area will afford a corresponding observation; and we may assume that in the White and Red Chalks of England the Madreporaria grew vastly more quickly than the deposit accumulated which subsequently environed and overwhelmed them. One of Lonsdale's discoveries was that of an *Amphihelian*-looking mass from the Chalk of Gravesend*; its bulk was considerable, and yet many of the calices were close to the base, and they were those of young buds. Again, in the Red Chalk the corals are often widely open and short and were probably very slow growers. All these considerations tend to the impression that the chalk of old, whatever may have been its original nature, accumulated extremely slowly.

The variability of the specimens of *Desmophyllum Crista-Galli* which were found on the cable is very great; and in some instances it is sufficient to permit of a specific distinction being made according to the strict classificatory rules. Doubtless had the specimens

* Suppl. to Brit. Foss. Corals, Cretaceous, Palæont. Soc. By P. M. Duncan.

been separated, and had they been assumed to have come from different localities, new species would have been made of them.

Several specimens are very costulate, and there are crests to all the larger costæ; in some there are wart-like growths in those situations, and in these forms the calice is sometimes widely open, or very compressed, or normally slightly so at its orifice.

In at least one fourth of the specimens the shape of the corallum, instead of being subturbinate and compressed above the round pedicel, is tall and cylindrical; and there are no costal ridges of any importance. Moreover the size of the calices and septa varies in this series.

Some specimens, otherwise normal, have very broad basal expansions out of all proportion with the height. But the most interesting variation is noticed in those specimens which have widely open calices and exsert septa; for, added to these specific structures, are costal crests, ridges, processes, and root-like projections coming from the body, peduncle, and base. These projections are either free at their end or are attached to some support; sometimes the growths are in relation to the costal line, and in others they cannot be maintained to be so, and they are either smooth, granular, or like shagreen. There is no epitheca on the coral, and the root-like projections are therefore growths of the ectoderm. Some act as supports; but most have been produced by the irritation of an Annelid, which, after boring out of the cable, came in contact with the coral, which endeavoured more or less successfully to cover it up.

Those processes which are beyond the reach of Annelids and which act as supports singularly resemble those root-like growths which are of generic or specific importance in many groups of Madreporaria.

Flabellum, *Rhizotrochus*, *Rhizophyllum*, *Omphyma*, &c. are genera which possess such root-forming species. But the root-like processes of *Flabellum* have a higher physiological interest than those of *Desmophyllum*; for some finally separate the base of the coral from its attachment by their downward growth-pressure; nevertheless the development of root-processes by the cable-covering *Desmophylla* is suggestive and important, although some are morbid growths.

The cylindroid specimens would most probably be considered specifically distinct from the others were they found away from them or in strata. They are very suggestive; for in palæontology the shape of the corallum, the contour of the calice, and the relative size of the septa are often considered to establish species; and such genera as *Trochocyathus*, *Trochosmilia*, and *Montlivaltia* amongst Mesozoic corals, and *Cyathophyllia* and *Zaphrentis* amongst the Rugosa, teem with specific names which are not established on better grounds than that of the cylindroid *Desmophyllum*.

The *Lophoheliæ* on the cable present great bud variation; and the young and old corallites are of many different shapes, from the turbinate to the tubular. But the most important structural peculi-

arities are of two kinds :—first, the annelid growth has determined outgrowth of the coral which has covered in the worm-tube ; and second, the establishment of some Hydrozoa on the ectoderm of the coral has sometimes produced the formation of tubes of coral-structure which environ the stalk of the offender and form a useful support to it.

Finally it may be remarked that all the Madreporaria which were brought up with the cable from off this area have an unusual ornamentation.

I have to thank Sir James Anderson for the specimens and for the details of the recovery of the cable.

MISCELLANEOUS.

On some Points in the Embryology of Annelids. By M. C. Barrois.

The investigations, of which I now give a summary, were made in the years 1873–76, and completed during the present year.

The first fact relates to the discovery of a new type, common at Roscoff during the month of April, which must be referred to the interesting group of the Gastrotricha. It possesses the form and general aspect of the Ichthydinæ ; but its skin is divided superficially into several segments furnished with incomplete ciliary circlets, which cause it to resemble the larva of an annelid. The digestive tube consists of three divisions, of which the first bears a very characteristic muscular pharyngeal inflation, which I have also met with in a small Syllidian, *Nerilla antennata*. The specimens were in full reproduction at the period when I collected them ; the genital organs form a series of glands, as in the Rhabdocœli. The sexes are separate : the males possess two testes, situated one to the right, the other to the left of the stomach, and which are followed by two seminal vesicles which pass to a single penis ; the female organs consist of two great masses, situated at the same part as the testes of the male ; and these ovarian masses, like the testes, are separated by a sort of dissepiment which divides the body of the animal into two parts.

Copulation occurs ; then the ova are deposited ; and in order to study them it is only necessary to collect them at the bottom of the vessel. The segmentation is like that of annelids generally : a gastrula is formed by epibolism ; then the internal mass is concentrated behind, while the anterior part becomes clear and the ventral surface thickens into an embryonic band ; the posterior fatty mass will form the stomach, the clear anterior part the œsophagus, and the embryonic band the muscular layer. The latter, the investigation of which would possess special interest, represents the